

Feature Article

The STARS Test Automation Platform

James Fowler

The STARS test automation platform has been developed by SRH Systems Ltd, the joint venture by HORIBA and Ricardo, to provide the base upon which a harmonized family of global automation systems and tools may be built. A service based architecture which is highly scalable was adopted in STARS. Whilst the underlying services and database structure are common to all applications and tools, each can superimpose its own user interface and application functionality. All STARS workstation systems can be connected to a STARS cluster server for on-line sharing of configuration and results data. A STARS application suite, where the added value of STARS is expected to be delivered, provides an integrated package of test functionality. By means of the application suites, customers can acquire and immediately apply advanced applications know-how.

Introduction

Until recently HORIBA and Schenck were selling and supporting many different test automation systems for engine, driveline, brake and chassis dynamometer testing - not an ideal situation. With this background in mind, SRH Systems, the joint venture by HORIBA, Ricardo and Schenck (at that time), was established with the objective of developing a single, global test automation platform upon which harmonized solutions for engine, driveline, brake and vehicle testing could be built. Six years later, STARS test automation platform is the result of this initiative. This article describes the architecture of the STARS platform and introduces some of the automation systems, controllers, options and tools which have been developed on this platform.

The STARS Platform

The requirements for STARS were ambitious, calling for a system that could support a wide range of applications, that would be highly configurable by applications engineers, and that would be appropriate for deployment in installations ranging from a single test stand to a large, mixed application multi-facility test field. A service based architecture was adopted to meet these objectives.

Figure 1 shows the STARS service based architecture in 'cluster' (distributed test field) configuration.

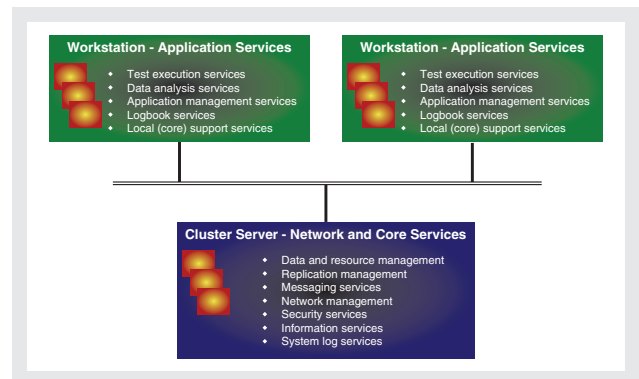


Figure 1 The STARS Service Based Architecture in Cluster' Configuration

In this architecture a hierarchical set of services provides data management, communication and generic applications support for the tests and displays running in the user environment of a STARS workstation or STARS based tool. This architecture is highly scalable, as the core services are capable of supporting a large number of concurrent STARS client connections when deployed in a distributed arrangement with a shared STARS cluster server. In the server configuration, a dynamic connection is maintained between each STARS workstation and the

cluster server, an arrangement which supports the sharing of configuration and results data on a very timely basis; no explicit data synchronization is required.

Structured Support for Products and Tools

A number of STARS application products and STARS platform based tools and controllers have been developed, with many more under development or planned for the future. Whilst the underlying services and database structure are common to all applications and tools, each can superimpose its own user interface and application functionality, allowing each product line to present a distinct user experience and to make use of task specific extensions to the generic functionality provided by the platform, whilst retaining the characteristics of the STARS family. These extensions come in the form of ‘application feature sets’, which overlay and extend the functionality of the core and applications services. Figure 2 shows the image of the feature sets which extend and customize the base STARS platform functionality for each STARS product.

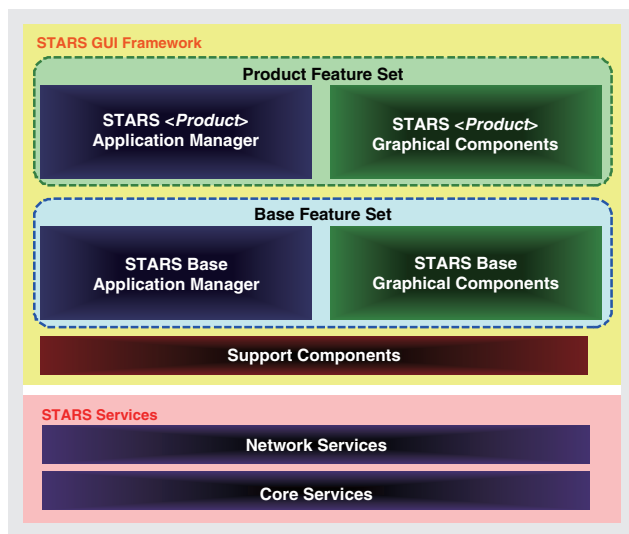


Figure 2 Extending and Customizing the Base STARS Platform Functionality by Application Feature Sets

The STARS Workstation

At the heart of the STARS product range are the STARS workstations. Different workstation variants exist to address the different application areas found within the powertrain development arena: STARS Engine; STARS Driveline; STARS Brake and STARS Vehicle (for chassis dynamometer rigs). All STARS workstation systems can be connected to a STARS cluster server for on-line

sharing of configuration and results data. In a test field running more than one type of STARS workstation these can be connected to the same STARS cluster server and some types of test can even be formulated to run without modification on different types of STARS workstation, e.g. a light duty emissions cycles can be run on an engine, driveline or vehicle test stand, with usually only the emissions equipment handling needing to be reconfigured for each different type of facility.

Each workstation product presents, to some extent, a different user experience as discussed in the previous section about the feature sets. For example, STARS Engine and STARS Driveline rely mainly on the generic user interface environment presented by the core feature set. In this case the user experience tends to be based around the explorer tree and shortcut bar for finding and executing tests, locating and accessing results, etc. The STARS work space is used to host the display pages and editors required to interact with or configure the various STARS resources used in a test. Figure 3 shows an example of user interface environment for STARS Engine.

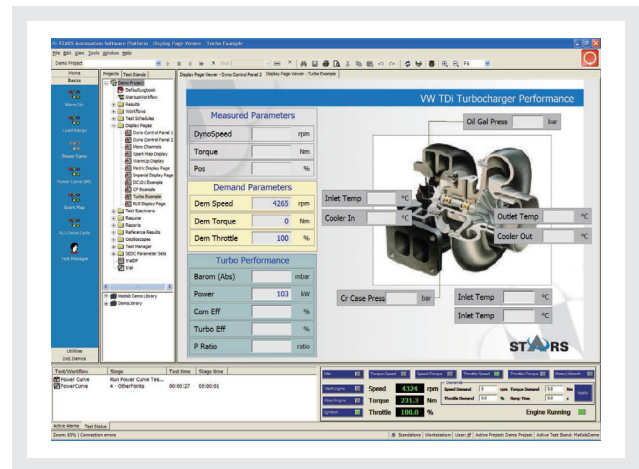


Figure 3 The STARS Engine User Interface Environment

The standard functionality of STARS workstation systems may be extended by installing one or more of the optional components. An optional component, or just option, typically provides a specific package of extended functionality coupled to a customized user interface. For example, the ‘Test Manager’ option provides a simple, integrated test definition and execution environment suitable for tests that may be structured as a series of steps, for example mapping tests based on a ramp/stabilize/measure paradigm. Such tools and options are typically packaged to integrate into the work space of the main STARS user interface framework. They can of course, like all STARS user interface components, be

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launched from the work space to run in stand-alone mode if required. Figure 4 shows an example of the Test Manager option window and companion display page, both launched from the STARS user interface.

STARS Standard Configurations

The initial encounter of a user with a sophisticated automation system such as STARS can be a daunting and sometimes frustrating experience, until they gain some familiarity with the STARS user environment and applications tools. To minimize the time taken for a user to become comfortable and productive with a new system, STARS workstation products are supplied with ready-to-run applications examples and pre-configured utility functions in the form of 'standard configurations'. The standard configurations essentially comprise libraries of preconfigured STARS resources, with example tests to show how these resources combine to carry out specific testing tasks. Whilst they are rarely exactly what the customer requires, they do help users become productive in a short period of time.

Whilst we cannot hope to anticipate the full range of applications requirements of our diverse customer base, the standard configurations are an important element in the orientation phase of working with a new STARS system. Even so, it is important to appreciate that the standard configurations augment rather than substitute the range of training courses available for STARS.

STARS Application Suites

From the customers' perspective, the most important aspect of a STARS system is the work that he/she can do with that system, i.e. the applications capability of STARS. While STARS was designed from the beginning to present a powerful applications toolbox, many customers are looking for this power to be provided in the form of ready made applications. In fact, in the eyes of the customer this is where the added value of STARS is expected to be delivered, with the base automation system more and more becoming a commodity item.

A 'STARS application suite' provides an integrated package of test functionality constructed predominantly, but not entirely, using the applications tools built into the STARS platform. By augmenting the STARS tools with purpose built components, the STARS application suites can provide a simpler environment optimally aligned to the application area concerned. By means of the application suites, customers can acquire and immediately apply advanced applications know-how that may not exist in their application.

The first application suite built for STARS was HDEET, a package encapsulating configuration, test execution, analysis and reporting functionality for emissions testing of heavy duty diesel engines. HDEET is available for STARS Engine workstations. This application suite includes the key emissions certification tests for Europe,

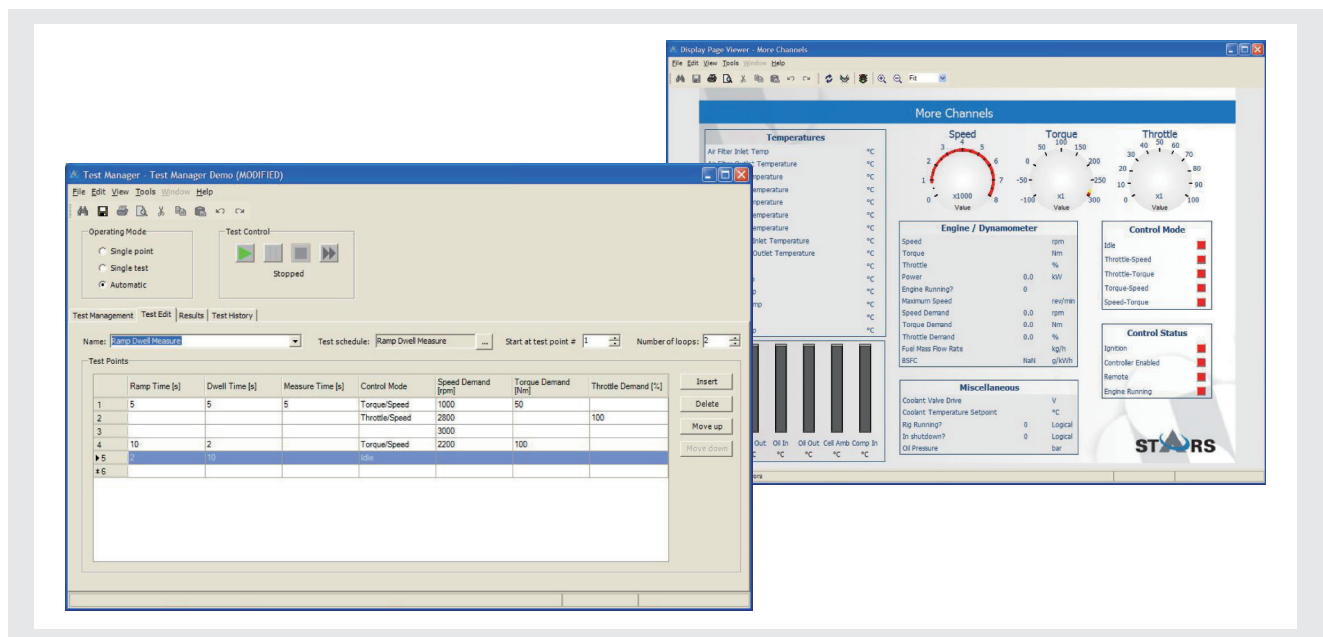


Figure 4 The Test Manager Option, with a Companion Display Page, Both Launched from the STARS GUI

the Americas and Asia, for both on-road and off-road regimes. All tests are implemented in compliance with the relevant legislative requirements.

The light duty counterpart of HDEET, LDEET, will support chassis dynamometer type light duty emissions cycle testing on engine, driveline and chassis dynamometer test stands. The LDEET application suite has recently been released and delivered during 2009. The test execution, analysis and reporting functionality encapsulated in LDEET is compatible with all these domains without modification, although it must be expected that the emissions analysis subsystems and test stand instrumentation will need to be configured appropriately in each case.

Whilst the application suites provide complete and ready to use sets of tests, they are designed to be highly customizable by the customer. The architecture of the applications suites is highly modular, with the 'content' (the STARS components used to deliver the functionality) structured in user accessible libraries. The customer can modify or replace components in these libraries to customize any aspect of a test. Beyond this, an entire test can be copied and used as the basis for a new test implementation. In this way customers benefit greatly from HORIBA's expertise in the application area concerned and the use of STARS to address that application, whilst not being reliant on HORIBA to change or extend the functionality of an application suite if required.

In future many more application suites will be offered, delivering a wide range of ready to run testing capability to the end user across the full breadth of the application domains supported by the STARS platform.

Conclusion - The Future of STARS

The STARS platform has already been used to realize a diversity of test automation products. The future will see a continuation of the rapid growth of the range of STARS based products offered by HORIBA, including the launch of the STARS Brake and STARS Vehicle workstations with many supporting application suites and options. A lightweight version of the STARS platform has also been used in conjunction with HORIBA's real-time control unit, SPARC, to develop new and powerful controller products. More of these controllers will be available in the future.

Efficient support for the wider testing process is

increasingly becoming the key to productivity in powertrain test operations. In future new tool chains to provide support for advanced data management and test field process management will be available with which to extend the already rich STARS environment.



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